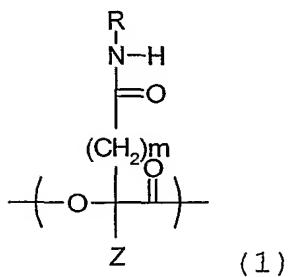


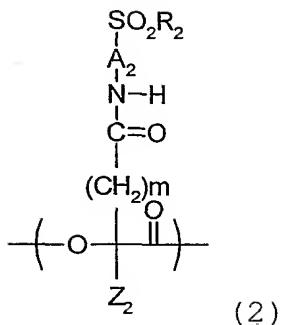
## CLAIMS

1. Polyhydroxyalkanoate comprised of at least a unit represented by a chemical formula (1) within the 5 molecule:

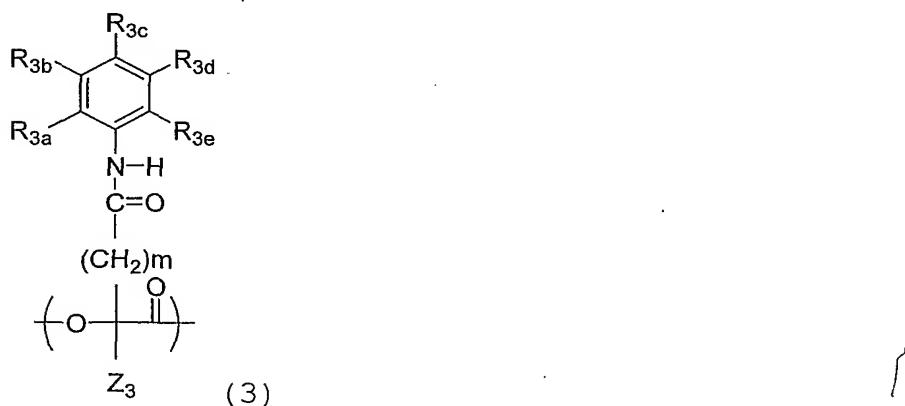


wherein R represents  $-A_1-SO_2R_1$ ;  $R_1$  represents OH, a halogen atom, ONa, OK or OR<sub>1a</sub>; R<sub>1a</sub> and A<sub>1</sub> each independently represents a group having a substituted or unsubstituted aliphatic hydrocarbon structure, a substituted or unsubstituted aromatic ring structure or a substituted or unsubstituted heterocyclic structure; m represents an integer selected from 0 - 8; Z represents a linear or branched alkyl group, an 10 aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present, R, 15 R<sub>1</sub>, R<sub>1a</sub>, A<sub>1</sub>, m and Z have the aforementioned meanings independently for each unit.

2. Polyhydroxyalkanoate according to claim 1, 20 comprised of, as the unit represented by the chemical formula (1), at least a unit represented by a chemical formula (2), a chemical formula (3), a chemical formula (4A) or (4B), within a molecule:

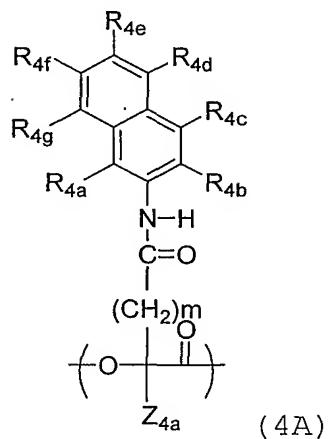


wherein R<sub>2</sub> represents OH, a halogen atom, ONa, OK or OR<sub>2a</sub>; R<sub>2a</sub> represents a linear or branched alkyl group with 1 to 8 carbon atoms or a substituted or  
5 unsubstituted phenyl group; A<sub>2</sub> represents a linear or branched alkylene group with 1 to 8 carbon atoms; m represents an integer selected from 0 - 8; Z<sub>2</sub> represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present, A<sub>2</sub>, R<sub>2</sub>,  
10 R<sub>2a</sub>, m and Z<sub>2</sub> have the aforementioned meanings independently for each unit;



wherein  $R_{3a}$ ,  $R_{3b}$ ,  $R_{3c}$ ,  $R_{3d}$  and  $R_{3e}$  each independently  
 15 represents  $SO_2R_{3f}$  ( $R_{3f}$  representing OH, a halogen atom,  
 $ONa$ ,  $OK$  or  $OR_{3f1}$  ( $R_{3f1}$  representing a linear or branched

alkyl group with 1 to 8 carbon atoms or a substituted or unsubstituted phenyl group)), a hydrogen atom, a halogen atom, an alkyl group with 1 - 20 carbon atoms, an alkoxy group with 1 - 20 carbon atoms, an OH group,  
 5 an NH<sub>2</sub> group, an NO<sub>2</sub> group, COOR<sub>3g</sub> (R<sub>3g</sub> representing a H atom, a Na atom or a K atom), an acetamide group, an OPh group, a NHPh group, a CF<sub>3</sub> group, a C<sub>2</sub>F<sub>5</sub> group or a C<sub>3</sub>F<sub>7</sub> group (Ph indicating a phenyl group), of which at least one is SO<sub>2</sub>R<sub>3f</sub>; m represents an integer  
 10 selected from 0 - 8; Z<sub>3</sub> represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present, R<sub>3a</sub>, R<sub>3b</sub>, R<sub>3c</sub>, R<sub>3d</sub>, R<sub>3e</sub>, R<sub>3f</sub>, R<sub>3f1</sub>, R<sub>3g</sub>, m and Z<sub>3</sub> have the aforementioned meanings  
 15 independently for each unit;

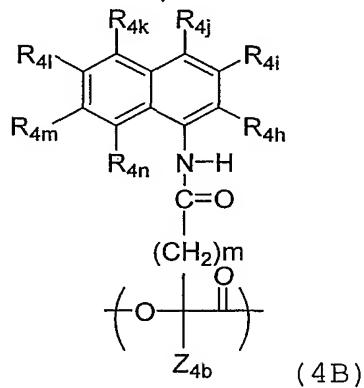


wherein R<sub>4a</sub>, R<sub>4b</sub>, R<sub>4c</sub>, R<sub>4d</sub>, R<sub>4e</sub>, R<sub>4f</sub> and R<sub>4g</sub> each independently represents SO<sub>2</sub>R<sub>4o</sub> (R<sub>4o</sub> representing OH, a halogen atom, ONa, OK or OR<sub>4o1</sub> (R<sub>4o1</sub> representing a linear or branched alkyl group with 1 to 8 carbon  
 20

atoms or a substituted or unsubstituted phenyl group), a hydrogen atom, a halogen atom, an alkyl group with 1 - 20 carbon atoms, an alkoxy group with 1 - 20 carbon atoms, an OH group, an NH<sub>2</sub> group, an NO<sub>2</sub> group, COOR<sub>4p</sub> (R<sub>4p</sub> representing a H atom, a Na atom or a K atom), an acetamide group, an OPh group, an NHPh group, a CF<sub>3</sub> group, a C<sub>2</sub>F<sub>5</sub> group or a C<sub>3</sub>F<sub>7</sub> group (Ph indicating a phenyl group), of which at least one is SO<sub>2</sub>R<sub>4o</sub>; m represents an integer selected from 0 - 8;

5 Z<sub>4a</sub> represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present, R<sub>4a</sub>, R<sub>4b</sub>, R<sub>4c</sub>, R<sub>4d</sub>, R<sub>4e</sub>, R<sub>4f</sub>, R<sub>4g</sub>, R<sub>4o</sub>, R<sub>4o1</sub>, R<sub>4p</sub>, m and Z<sub>4a</sub> have the aforementioned meanings independently for each

10 15 unit;

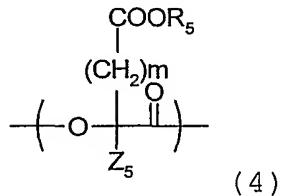


wherein R<sub>4h</sub>, R<sub>4i</sub>, R<sub>4j</sub>, R<sub>4k</sub>, R<sub>4l</sub>, R<sub>4m</sub> and R<sub>4n</sub> each independently represents SO<sub>2</sub>R<sub>4o</sub> (R<sub>4o</sub> representing OH, a halogen atom, ONa, OK or OR<sub>4o1</sub> (R<sub>4o1</sub> representing a

20 linear or branched alkyl group with 1 to 8 carbon atoms or a substituted or unsubstituted phenyl

group)), a hydrogen atom, a halogen atom, an alkyl group with 1 - 20 carbon atoms, an alkoxy group with 1 - 20 carbon atoms, an OH group, an NH<sub>2</sub> group, an NO<sub>2</sub> group, COOR<sub>4p</sub> (R<sub>4p</sub> representing a H atom, a Na atom or a K atom), an acetamide group, an OPh group, an NHPH group, a CF<sub>3</sub> group, a C<sub>2</sub>F<sub>5</sub> group or a C<sub>3</sub>F<sub>7</sub> group (Ph indicating a phenyl group), of which at least one is SO<sub>2</sub>R<sub>4o</sub>; m represents an integer selected from 0 - 8; Z<sub>4b</sub> represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present, R<sub>4h</sub>, R<sub>4i</sub>, R<sub>4j</sub>, R<sub>4k</sub>, R<sub>4l</sub>, R<sub>4m</sub>, R<sub>4n</sub>, R<sub>4o</sub>, R<sub>4o1</sub>, R<sub>4p</sub>, m and Z<sub>4b</sub> have the aforementioned meanings independently for each unit.

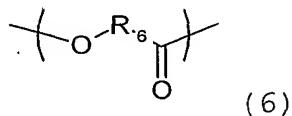
15 3. Polyhydroxyalkanoate comprised of at least a unit represented by a chemical formula (5) within a molecule:



wherein R<sub>5</sub> represents hydrogen, a group capable of forming a salt or R<sub>5a</sub>; R<sub>5a</sub> represents a linear or branched alkyl group with 1 - 12 carbon atoms, an aralkyl group or a substituent having a sugar; m represents an integer selected from 0 - 8; Z<sub>5</sub> represents a linear or branched alkyl group, an aryl

group or an aralkyl group substituted with an aryl group; however R<sub>5</sub> only represents a substituent having a sugar in case Z<sub>5</sub> is a methyl group and m is 0 - 1; and in case plural units are present, R<sub>5</sub>, R<sub>5a</sub>, 5 m and Z<sub>5</sub> have the aforementioned meanings independently for each unit.

4. Polyhydroxyalkanoate according to any one of claims 1 to 3, further comprised of a unit represented by a chemical formula (6) within a 10 molecule:

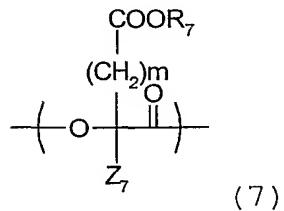


wherein R<sub>6</sub> represents a linear or branched alkylene with 1 - 11 carbon atoms, alkyleneoxyalkylene group (each alkylene group being independently with 1 - 2 15 carbon atoms), a linear or branched alkenyl group with 1 - 11 carbon atoms or an alkylidene group with 1 - 5 carbon atoms which may be substituted with an aryl group; and in case plural units are present, R<sub>6</sub> has the aforementioned meanings independently for 20 each unit.

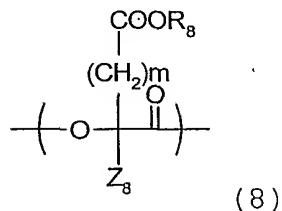
5. A method for producing a polyhydroxyalkanoate comprising a unit represented by a chemical formula (8), comprised of a step of executing hydrolysis of a polyhydroxyalkanoate 25 comprising a unit represented by a chemical formula

(7) in the presence of an acid or an alkali, or a step of executing hydrogenolysis comprising a catalytic reduction of a polyhydroxyalkanoate comprising a unit represented by a chemical formula

5 (7) :



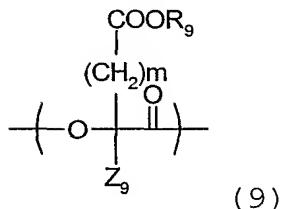
wherein R<sub>7</sub> represents a linear or branched alkyl group with 1 - 12 carbon atoms or an aralkyl group; m represents an integer selected from 0 - 8; Z<sub>7</sub> represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group, and m represents an integer selected from 2 - 8 in case Z<sub>7</sub> is a methyl group; and in case plural units are present, R<sub>7</sub>, m and Z<sub>7</sub> have the 15 aforementioned meanings independently for each unit;



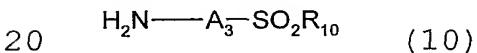
wherein R<sub>8</sub> represents hydrogen, or a group capable of forming a salt; m represents an integer selected from 0 - 8; Z<sub>8</sub> represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group, and m represents an integer selected from 20

2 - 8 in case  $Z_8$  is a methyl group; and, in case plural units are present,  $R_8$ ,  $m$  and  $Z_8$  have the aforementioned meanings independently for each unit.

6. A method for producing a  
 5 polyhydroxyalkanoate comprising a unit represented by a chemical formula (1), comprised of a step of executing a condensation reaction of a polyhydroxyalkanoate comprising a unit represented by a chemical formula (9) and an amine compound  
 10 represented by a chemical formula (10):

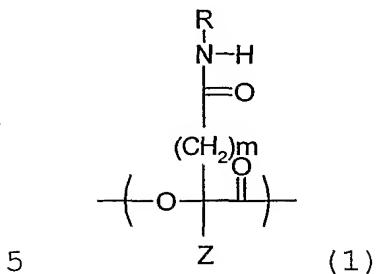


- wherein  $R_9$  represents hydrogen, or a group capable of forming a salt;  $m$  represents an integer selected from 0 - 8;  $Z_9$  represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and, in case plural units are present,  $m$ ,  $R_9$  and  $Z_9$  have the aforementioned meanings independently for each unit;



wherein  $R_{10}$  represents OH, a halogen atom, ONa, OK or OR<sub>10a</sub>; R<sub>10a</sub> and A<sub>3</sub> each independently is selected from a group having a substituted or unsubstituted aliphatic hydrocarbon structure, a substituted or unsubstituted

aromatic ring structure, or a substituted or unsubstituted heterocyclic structure; and, in case plural units are present,  $R_{10}$ ,  $R_{10a}$  and  $A_3$  have the aforementioned meanings independently for each unit;

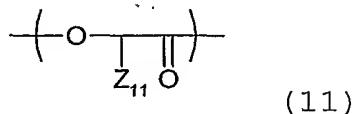


wherein R represents  $-A_1-SO_2R_1$ ;  $R_1$  represents OH, a halogen atom, ONa, OK or OR<sub>1a</sub>; R<sub>1a</sub> and A<sub>1</sub> each independently represents a group having a substituted or unsubstituted aliphatic hydrocarbon structure, a substituted or unsubstituted aromatic ring structure or a substituted or unsubstituted heterocyclic structure; m represents an integer selected from 0 - 8; Z represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present, R, R<sub>1</sub>, R<sub>1a</sub>, A<sub>1</sub>, m and Z have the aforementioned meanings independently for each unit.

7. A method for producing a polyhydroxyalkanoate comprising a unit represented by  
20 a chemical formula (13), comprised of:

a step of reacting a polyhydroxyalkanoate comprising a unit represented by a chemical formula (11) with a base; and

a step of reacting a compound obtained in the aforementioned step with a compound represented by a chemical formula (12):



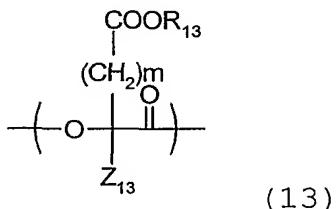
- 5 wherein  $Z_{11}$  represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present,  $Z_{11}$  has the aforementioned meanings independently for each unit;

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- wherein  $m$  represents an integer selected from 0 - 8; X represents a halogen atom; and  $R_{12}$  represents a linear or branched alkyl group with 1 - 12 carbon atoms or an aralkyl group;

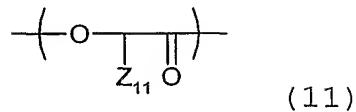
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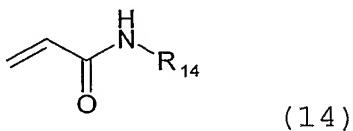
- wherein  $m$  represents an integer selected from 0 - 8;  $R_{13}$  represents a linear or branched alkyl group with 1 - 12 carbon atoms or an aralkyl group;  $Z_{13}$  represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group, and  $m$  represents an integer selected from 2 - 8 in case  $Z_{13}$

is a methyl group; and in case plural units are present, R<sub>13</sub>, m and Z<sub>13</sub> have the aforementioned meanings independently for each unit.

8. A method for producing a  
 5 polyhydroxyalkanoate comprising a unit represented by a chemical formula (15), comprised of:  
 a step of reacting a polyhydroxyalkanoate comprising a unit represented by a chemical formula (11) with a base; and  
 10 a step of reacting a compound obtained in the aforementioned step with a compound represented by a chemical formula (14):

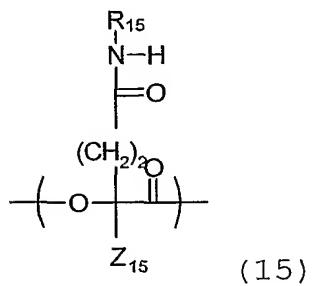


wherein Z<sub>11</sub> represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present, Z<sub>11</sub> has the aforementioned meanings independently for each unit;



- 20 wherein R<sub>14</sub> represents -A<sub>14</sub>-SO<sub>2</sub>R<sub>14a</sub>; R<sub>14a</sub> represents OH, a halogen atom, ONa, OK or OR<sub>14b</sub>; R<sub>14b</sub> and A<sub>14</sub> each independently is selected from a group having a substituted or unsubstituted aliphatic hydrocarbon

structure, a substituted or unsubstituted aromatic ring structure or a substituted or unsubstituted heterocyclic structure; and in case plural units are present,  $R_{14}$ ,  $R_{14a}$ ,  $R_{14b}$ , and  $A_{14}$  have the  
 5 aforementioned meanings independently for each unit;



wherein  $R_{15}$  represents  $-A_{15}-SO_2R_{15a}$ ;  $R_{15a}$  represents OH, a halogen atom, ONa, OK or OR<sub>15b</sub>;  $R_{15b}$  and  $A_{15}$  each independently represents a group having a substituted or unsubstituted aliphatic hydrocarbon structure, a substituted or unsubstituted aromatic ring structure or a substituted or unsubstituted heterocyclic structure;  $Z_{15}$  represents a linear or branched alkyl group, an aryl group or an aralkyl group substituted with an aryl group; and in case plural units are present,  $R_{15}$ ,  $R_{15a}$ ,  $R_{15b}$ , and  $A_{15}$  have the  
 10 aforementioned meanings independently for each unit.  
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